

Amendments to the Claims

This listing of claims will replace all prior versions and listing of claims in the application.

Claims 1-30 (canceled)

Claim 31 (previously presented): An electrochemical system comprising:
an electrochemical cell including:

(a) an anode;

(b) a cathode, and

(c) a selectively proton-conducting membrane disposed between, and being in communication with, said anode and said cathode, said membrane containing:

(i) a hydrophobic matrix polymer and

(ii) a hydrophilic non-ionic polymer,

wherein said proton-conducting membrane is a single-phase, substantially non-porous structure.

Claim 32 (original): The electrochemical system of claim 31, said anode including at least one material having a metal whose cation can assume at least two different non-zero oxidation numbers, said cathode including a compound forming an electrochemical couple with said anode, and wherein said cell is inherently active in imitation of discharge under ambient conditions.

Claim 33 (original): The electrochemical system of claim 31, wherein said anode includes an organic compound that is a source of protons during discharge, and wherein said cathode includes a compound which forms an electrochemical couple with said anode.

Claim 34 (withdrawn): The electrochemical system according to claim 31, wherein said electrochemical cell is a fuel cell.

Claim 35 (withdrawn): The electrochemical system according to claim 34, wherein an anodic fuel of said fuel cell is an organic liquid.

Claim 36 (withdrawn): The electrochemical system according to claim 34, wherein an anodic fuel of said fuel cell is hydrogen.

Claim 37 (original): The electrochemical system according to claim 31, wherein said anode forms a first layer, said cathode forms a second layer, and wherein said selectively proton-conducting membrane is structured as a layer in an integrated assembly, said assembly further including at least one of said first and second layers affixed to said membrane.

Claim 38 (original): The electrochemical system according to claim 31, wherein said anode contains a compound of tin.

Claim 39 (original): The electrochemical system according to claim 31, wherein said cathode contains a compound of manganese.

Claim 40 (original): The electrochemical system according to claim 31, wherein said anode contains a compound of tin, and wherein said cathode contains a compound of manganese.

Claim 41 (withdrawn): The electrochemical system according to claim 31, wherein said electrochemical cell is a rechargeable battery.

Claim 42 (withdrawn): The electrochemical system according to claim 41, wherein said rechargeable battery has a thickness of about 0.2 mm to about 8 mm.

Claim 43 (withdrawn): The electrochemical system according to claim 41, wherein each of said anode and said cathode have a thickness of about 30 microns to about 600 microns.

Claim 44 (withdrawn): The electrochemical system according to claim 41, wherein said battery is disposed in a smart card.

Claim 45 (withdrawn): The electrochemical system according to claim 41, wherein said battery is disposed in an RF tag.

Claim 46 (original): The electrochemical system according to claim 31, wherein said electrochemical cell is an electrochemical double layer capacitor.

Claim 47 (original): The electrochemical system according to claim 46, wherein said double layer capacitor has a plurality of electrodes, and wherein each of said electrodes has a thickness of about 30 microns to about 300 microns.

Claim 48 (original): The electrochemical system according to claim 46, wherein said double layer capacitor has a plurality of electrodes, and wherein at least one of said electrodes includes a high surface area carbon material and a protonic medium, said protonic medium selected from the group of materials consisting of water, aqueous acid solutions, sulfonic acids, compounds having at least one alcohol group, and combinations thereof.

Claim 49 (original): The electrochemical system according to claim 46, wherein said double layer capacitor has a thickness of about 0.2 mm to about 7 mm.

Claim 50 (withdrawn): The electrochemical system according to claim 31, wherein said electrochemical cell is a pseudo-capacitor.

Claim 51 (withdrawn): The electrochemical system according to claim 31, wherein said electrochemical cell is a non-rechargeable battery.

Claim 52 (withdrawn): The electrochemical system according to claim 41, wherein said hydrophobic matrix polymer is PVDF, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains between 57% and 67% PVDF, and between 33% and 43% PVP.

Claim 53 (withdrawn): The electrochemical system according to claim 41, wherein said hydrophobic matrix polymer is PVDF, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains a PVDF to PVP weight ratio of between 1.32 to 1 and 2.03 to 1.

Claim 54 (withdrawn): The electrochemical system according to claim 41, wherein said hydrophobic matrix polymer is PVDF-HFP, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains between 57% and 67% PVDF-HFP, and between 33% and 43% PVP.

Claim 55 (withdrawn): The electrochemical system according to claim 41, wherein said hydrophobic matrix polymer is PVDF-HFP, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains a PVDF-HFP to PVP weight ratio of between 1.32 to 1 and 2.03 to 1.

Claim 56 (original): The electrochemical system according to claim 46, wherein said hydrophobic matrix polymer is PVDF, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains between 25% and 33% PVDF, and between 67% and 75% PVP.

Claim 57 (original): The electrochemical system according to claim 46, wherein said hydrophobic matrix polymer is PVDF, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains a PVDF to PVP weight ratio of between 0.33 to 1 and 0.50 to 1.

Claim 58 (original): The electrochemical system according to claim 46, wherein said hydrophobic matrix polymer is PVDF-HFP, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains between 25% and 33% PVDF-HFP, and between 67% and 75% PVP.

Claim 59 (original): The electrochemical system according to claim 46, wherein said hydrophobic matrix polymer is PVDF-HFP, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains a PVDF-HFP to PVP weight ratio of between 0.33 to 1 and 0.50 to 1.

Claim 60 (withdrawn): A method of operating an electrochemical cell, the method comprising the steps of:

(a) providing an electrochemical cell including:

(i) an anode;

(ii) a cathode, and

(iii) a consolidated selectively proton-conducting membrane disposed between, and being in communication with, said anode and said cathode, wherein said proton-conducting membrane is a single-phase, substantially non-porous structure.

(b) transporting protons across said membrane, between said anode and said cathode, and

(c) substantially obstructing at least one species other than protons from passing through said membrane.

Claims 61-62 (canceled).

Claim 63 (new): An electrochemical system comprising:

an electrochemical cell including:

(a) an anode;

(b) a cathode, and

(c) a selectively proton-conducting membrane disposed between, and being in communication with, said anode and said cathode, said membrane containing:

(i) a hydrophobic matrix polymer and

(ii) a hydrophilic non-ionic polymer,

wherein said proton-conducting membrane is a single-phase structure.

Claim 64 (new): The electrochemical system of claim 63, said anode including at least one material having a metal whose cation can assume at least two different non-zero oxidation numbers, said cathode including a compound forming an electrochemical couple with said anode, and wherein said cell is inherently active in imitation of discharge under ambient conditions.

Claim 65 (new): The electrochemical system of claim 63, wherein said anode includes an organic compound that is a source of protons during discharge, and wherein said cathode includes a compound which forms an electrochemical couple with said anode.

Claim 66 (new): The electrochemical system according to claim 63, wherein said electrochemical cell is a fuel cell.

Claim 67 (new): The electrochemical system according to claim 66, wherein an anodic fuel of said fuel cell is an organic liquid.

Claim 68 (new): The electrochemical system according to claim 66, wherein an anodic fuel of said fuel cell is hydrogen.

Claim 69 (new): The electrochemical system according to claim 63, wherein said anode forms a first layer, said cathode forms a second layer, and wherein said selectively proton-conducting membrane is structured as a layer in an integrated assembly, said assembly further including at least one of said first and second layers affixed to said membrane.

Claim 70 (new): The electrochemical system according to claim 63, wherein said anode contains a compound of tin.

Claim 71 (new): The electrochemical system according to claim 63, wherein said cathode contains a compound of manganese.

Claim 72 (new): The electrochemical system according to claim 63, wherein said anode contains a compound of tin, and wherein said cathode contains a compound of manganese.

Claim 73 (new): The electrochemical system according to claim 63, wherein said electrochemical cell is a rechargeable battery.

Claim 74 (new): The electrochemical system according to claim 73, wherein said rechargeable battery has a thickness of about 0.2 mm to about 8 mm.

Claim 75 (new): The electrochemical system according to claim 73, wherein each of said anode and said cathode have a thickness of about 30 microns to about 600 microns.

Claim 76 (new): The electrochemical system according to claim 73, wherein said battery is disposed in a smart card.

Claim 77 (new): The electrochemical system according to claim 73, wherein said battery is disposed in an RF tag.

Claim 78 (new): The electrochemical system according to claim 63, wherein said electrochemical cell is an electrochemical double layer capacitor.

Claim 79 (new): The electrochemical system according to claim 78, wherein said double layer capacitor has a plurality of electrodes, and wherein each of said electrodes has a thickness of about 30 microns to about 300 microns.

Claim 80 (new): The electrochemical system according to claim 78, wherein said double layer capacitor has a plurality of electrodes, and wherein at least one of said electrodes includes a high surface area carbon material and a protonic medium, said protonic medium selected from the group of materials consisting of water, aqueous acid solutions, sulfonic acids, compounds having at least one alcohol group, and combinations thereof.

Claim 81 (new): The electrochemical system according to claim 78, wherein said double layer capacitor has a thickness of about 0.2 mm to about 7 mm.

Claim 82 (new): The electrochemical system according to claim 63, wherein said electrochemical cell is a pseudo-capacitor.

Claim 83 (new): The electrochemical system according to claim 63, wherein said electrochemical cell is a non-rechargeable battery.

Claim 84 (new): The electrochemical system according to claim 73, wherein said hydrophobic matrix polymer is PVDF, and said hydrophilic non-ionic polymer is PVP,

and wherein said membrane contains between 57% and 67% PVDF, and between 33% and 43% PVP.

Claim 85 (new): The electrochemical system according to claim 73, wherein said hydrophobic matrix polymer is PVDF, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains a PVDF to PVP weight ratio of between 1.32 to 1 and 2.03 to 1.

Claim 86 (new): The electrochemical system according to claim 73, wherein said hydrophobic matrix polymer is PVDF-HFP, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains between 57% and 67% PVDF-HFP, and between 33% and 43% PVP.

Claim 87 (new): The electrochemical system according to claim 73, wherein said hydrophobic matrix polymer is PVDF-HFP, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains a PVDF-HFP to PVP weight ratio of between 1.32 to 1 and 2.03 to 1.

Claim 88 (new): The electrochemical system according to claim 78, wherein said hydrophobic matrix polymer is PVDF, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains between 25% and 33% PVDF, and between 67% and 75% PVP.

Claim 89 (new): The electrochemical system according to claim 78, wherein said hydrophobic matrix polymer is PVDF, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains a PVDF to PVP weight ratio of between 0.33 to 1 and 0.50 to 1.

Claim 90 (new): The electrochemical system according to claim 78, wherein said hydrophobic matrix polymer is PVDF-HFP, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains between 25% and 33% PVDF-HFP, and between 67% and 75% PVP.

Claim 91 (new): The electrochemical system according to claim 78, wherein said hydrophobic matrix polymer is PVDF-HFP, and said hydrophilic non-ionic polymer is PVP, and wherein said membrane contains a PVDF-HFP to PVP weight ratio of between 0.33 to 1 and 0.50 to 1.

Claim 92 (new): A method of operating an electrochemical cell, the method comprising the steps of:

(a) providing an electrochemical cell including:

(i) an anode;

(ii) a cathode, and

(iii) a consolidated selectively proton-conducting membrane disposed between, and being in communication with, said anode and said cathode, wherein said proton-conducting membrane is a single-phase structure.

(b) transporting protons across said membrane, between said anode and said cathode, and

(c) substantially obstructing at least one species other than protons from passing through said membrane.